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NOTES ON
RECENT ADVANCES IN THE TREATMENT
OF
WOUNDS AND BURNS

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WOUNDS

Under the stress of emergency conditions, modern practices in the handling of wounds and surgical cases should not be overlooked. The following suggestions are based on the latest information.

GENERAL PRINCIPLES GOVERNING THE PREVENTION OF INFECTION IN WOUNDS:

(a) All wounded men should receive their "booster" (or stimulating) dose of tetanus toxoid as soon as possible after being wounded.

(b) When immediate debridement is not possible, crystalline sulfanilamide should be placed in the wound, and a sterile temporary dressing applied until such time as debridement can be accomplished.

(c) Debridement should be performed as soon as practicable thereafter, irrespective of the time which has elapsed since wounded, and the fact that sulfanilamide has been used. Great care should be exercised to prevent further damage to major vessels and nerves. All necrotic tissue should be excised, after which the wound should be irrigated thoroughly with sterile physiological saline solution. Sulfanilamide crystals should then be placed in the wound before dressing. Not more than 5 grams should be used in any one wound or more than 10 grams in all wounds of a single patient.

(d) Complete primary suture should not be practiced except in the case of superficial flesh wounds, in which, after debridement, sulfanilamide crystals should be sprinkled and the wound closed at the discretion of the operator.

(e) After debridement, irrigation, and the use of sulfanilamide crystals, the area should be covered with sterile vaseline gauze and carefully dressed.

INTRA-ABDOMINAL WOUNDS, WITH PERFORATION OF VISCERA:

(a) Institute prompt shock therapy as follows:

(1) morphine; (2) apply warmth; (3) give plasma intravenously; and (4) administer stimulants.

(b) Use open drop ether ANAESTHESIA, unless an expert anaesthetist is available. Caution: This type of patient does not do well under spinal or intravenous anaesthesia.

(c) Scrub abdominal wall with soap and water, protecting the wound or wounds of entrance with moist sterile gauze soaked in crystalline sulfanilamide.

(d) Excise wound of entrance and pack with crystalline sulfanilamide. Enter the abdomen through a separate incision.

(e) Remove all gross fluid soiling the peritoneum by suction or sponging.

(f) Suture perforations of the intestines. Avoid resections unless absolutely necessary. Close perforations transversely to protect the intestinal lumen.

(g) Inspect full length of intestines thoroughly for the presence of more than one perforation.

(h) Control all bleeding points in mesentery.

(i) Introduce 5 grams of sulfanilamide crystals in the peritoneum, well dispersed over contaminated areas before closing.

(j) Drainage is an individual problem, but it should be remembered that:

- (1) It is impossible to drain the entire peritoneal cavity.
- (2) Drainage interferes with the healing of intestinal suture lines. Avoid it unless absolutely necessary.
- (3) If contamination has occurred during operation, drain the wound, and place sulfanilamide crystals in the abdominal wound as it is closed.

USE OF CHEMOTHERAPY IN THE TREATMENT OF WOUNDS:

Sulfanilamide is the drug of choice for parenteral therapy, sulfadiazine is the drug of choice for oral therapy.

(a) Parenterally--Give 1% solution of sulfanilamide in sterile physiological saline by any parenteral route, 150 cc every 6 hours for 4 to 7 days after operation.

Preparation--

- (1) Add 1.0 gram of crystalline sulfanilamide to every 100 cc of hot sterile physiological saline solution. Boil for 5 minutes to sterilize. Allow to cool to 37°C and administer subcutaneously under

fascia, lateral side of thigh. It is highly desirable that all sulfanilamide for local use be sterilized by exposure to dry heat for 2 hours at a temperature of 150°F (65.6°C).

- (2) Sodium sulfadiazine may also be used. Prepare by adding 5 grams to 100 cc of sterile distilled water. Do not attempt to sterilize. It can only be used intravenously. Never give sodium sulfadiazine intramuscularly or subcutaneously since it is highly alkaline and may cause a slough. Initial dosage of sodium sulfadiazine is calculated on basis of 0.1 gram per kilo of body weight. Subsequent dosage: 0.03 gram per kilo of body weight given intravenously as a 5% solution every 12 hours for 4 days.

(b) Orally--Two grams of sodium sulfadiazine should be taken at once orally, immediately after the wound is received. Following this, 1.0 gram should be given every 6 hours. In order to maintain a proper blood level of the drug, it should be given around the clock. For convenience of administration it is recommended that it be administered at 0600, 1200, 1800, and 2400, awakening the patient when necessary. Treatment should be continued for 7 days at which time, if the wound is clean and there is absence of fever attributable to infection, oral therapy should be discontinued. If the wound is infected, treatment should be continued as indicated.

(c) Precautions--

- (1) If the patient is not voiding normally, (1,000 cc per day), the blood concentration of the drug should be determined daily and dosage adjusted downward.
- (2) For local use, crystalline sulfanilamide is the most satisfactory. Sulfathiazole powder tends to cake, and may act as a foreign body.

PENETRATING, OR THROUGH AND THROUGH WOUNDS:

(a) Prepare suspension of sulfanilamide crystals in sterile physiological saline (sulfanilamide solubility varies considerably, from .75 gram in 100 cc at 25°C to 47 grams in 100 cc at 100°C). Such a suspension of the crystals can be used as a means of introducing sulfanilamide into deep wounds.

(b) The suspension should be made up at the time of use, and the syringe containing it should be rotated while it is being introduced into the wound in order to maintain the suspension.

(c) When gauze drains or wicks are used, moisten them in sterile saline solution, and dip in crystalline sulfanilamide before introducing them into the wound. "Frost" the wound by dusting with crystalline sulfanilamide before applying the dressing. Repeat this procedure with each dressing until the wound is healed.

AFTER CARE OF COMPOUND FRACTURES TREATED BY THE ORR-TRUEETA METHOD:

(a) Each time that the cast is removed, "frost" the wound area with crystalline sulfanilamide. If pus is present, precede this "frosting" with gentle irrigation, using sterile physiological saline solution. If a necrotic crust is present, before "frosting" irrigate gently with azochloramide or comparable solution every 6 hours until necrotic material is removed.

CAUTION: THE FULL VALUE OF SULFANILAMIDE CRYSTALS IS NOT OBTAINABLE WHEN DUSTED ON PUS OR NECROTIC MATERIAL BECAUSE SUCH MATERIAL CONTAINS SUBSTANCES WHICH NULLIFY THE ACTION OF SULFANILAMIDE AND ITS DERIVATIVES.

(b) After the wound has been cleaned, it should be "frosted" with crystalline sulfanilamide at each dressing until healed.

(c) If crystalline sulfanilamide appears to be ineffective after a thorough trial and infection persists, cultures should be made to determine whether an anaerobic streptococcal infection is present.

GENERAL PRINCIPLES FOR PREVENTION OF INFECTION IN WOUNDS:

(a) All dressings should be done at least an hour after bed linens have been changed and floors swept.

(b) While dressings are being done, windows should be closed, patients should remain in bed, ward doors should be closed, and traffic through the ward reduced to a minimum.

(c) Dirty linen should be bagged or placed in closed receptacles immediately after removal from the bed. Under no circumstances should bed linen be thrown on the floor.

(d) Regular dressing schedules should be made out and posted for each day of the week and in every ward where indicated.

(e) All wound dressers and assistants must be adequately masked and gowned, and the hands of dressers should be thoroughly

scrubbed for 10 minutes before beginning the dressings. Whenever practicable patients should be masked during the dressing period.

(f) Do the clean dressings first and the most severely infected last.

(g) Use forceps to remove and apply gauze dressings. Fingers should never be used. If forceps, hemostats and scissors are used (the so-called "knife and fork" technique) the dressings can be done satisfactorily without gloves.

(h) One assistant should be designated to remove old dressings. He should place contaminated dressings and used instruments in closed containers. A sterile assistant should handle only sterilized dressings and materials.

(i) It is important to remember that a wound or operation site need not be dressed merely because the dressings become moist from serum. Unnecessary and repeated dressings always increase the possibility of contamination and infection. Irrigate all suppurative wounds thoroughly with sterile normal saline, and finish by sprinkling the wound surfaces with sulfanilamide.

(j) Dressers or assistants suffering from upper respiratory infections such as colds, grippe, sore throat and pustular infections of the skin, hands, or fingers, should be relieved of these duties, if practicable.

BURNS

The National Research Council has evaluated the latest information available on the treatment of burns. The result of this research is herewith presented as a suggested method of treatment to be followed whenever practicable.

I. **FIRST AID TREATMENT:** To be used only in case definitive treatment cannot be carried out within two hours.

1. Pain: Morphine in adequate doses, one-half grain or more if needed.

2. Burned Area:

A. Hands, face, and genitalia.

(1) Medication:

(a) Aqueous emulsion containing 5% sulfadiazine liberally applied.

- (b) Boric acid ointment if above is not available.

(2) Dressing:

- (a) Cover burned areas with a fine mesh gauze (44 mesh per inch).
- (b) Apply firm bandage using cotton waste to the hands. Do not bandage face and genitalia.

B. Trunk, arms, and legs.

(1) Medication:

- (a) Liberal application of a water-soluble jelly containing 10% tannic acid and 5% sulfadiazine.

(2) Dressing:

- (a) Cover with sterile gauze. TO CONSERVE HEAT REMOVE AS LITTLE CLOTHING AS PRACTICABLE.

C. Eyes.

(1) Medication:

- (a) A single instillation, if necessary, of 2% Butyn Ophthalmic ointment. Do not rub eyes - danger of injury to anesthetized cornea.

- 3. Plasma: Intravenous injection of 500 cc if possible.
- 4. Human serum albumin (concentrated): Intravenous injection of 100 cc (1 unit) if possible. One unit is equivalent to approximately 500 cc of blood plasma therapeutically.

II. DEFINITIVE TREATMENT: Should be instituted as quickly as the patient can be evacuated to adequate facilities. Shock and infection are of outstanding importance.

- 1. Pain: Morphine in adequate doses, one-half grain or more if needed.
- 2. Plasma: Object is to replace the volume of serum lost. May be administered before any laboratory work is done.

3. Human serum albumin (concentrated): Object is to combat shock and to prevent edema. May be administered before any laboratory work is done.

4. Burned Area:

A. Hands, face, and genitalia.

- (1) Remove dressings.
- (2) Cleanse. If covered with oil, use detergent followed by white soap (Ivory or similar) and water. Do not scrub and do not use Tincture of Green Soap.
- (3) Debridement - drain blisters and excise necrotic tissue.
- (4) Medication:
 - (a) Aqueous emulsion containing 5% sulfadiazine liberally applied.
 - (b) Boric acid ointment if above is not available.
- (5) Dressing:
 - (a) Cover burned areas with a fine mesh gauze (44 mesh per inch).
 - (b) Reapply firm pressure dressing to hands using waste cotton. The fingers should be "semiflexed" with the thumb in apposition. Do not bandage face and genitalia.
 - (c) Open surgical drainage is to be maintained and the dressing is to be changed only when necessary.

B. Trunk, arms, and legs.

- (1) Remove dressings.
- (2) Cleanse. If covered with oil, use detergent followed by white soap (Ivory or similar) and water. Do not scrub and do not use Tincture of Green Soap.
- (3) Debridement - drain blisters and excise necrotic tissue.

- (4) After thorough cleansing and debridement have been accomplished, rinse the surface freely with physiologic saline (body temperature). Surface is now ready to be tanned.
- (5) Tanning: A burn more than 24 hours old should not be tanned. Treat as an infected burn. (See II-B (5) (d), 2/, 3/, and 4/ below).

(a) Solutions needed:

- 1/ A freshly prepared 10% solution of tannic acid.
- 2/ Silver nitrate solution 10%.

(b) Method:

- 1/ Using a spray gun, spray entire area to be tanned with tannic acid, followed immediately by spraying with solution containing equal parts 10% tannic acid and 10% silver nitrate.

(c) Subsequent spraying:

- 1/ One-half hour later and every half hour thereafter, for four applications, spray with the tannic acid-silver nitrate mixture.
- 2/ If area is not adequately tanned, continue the spraying of surfaces every hour until satisfactory tanning has been accomplished.

(d) Infection beneath tan:

- 1/ Unroof tan over area of suppuration only.
- 2/ Cleanse with warm normal saline using cotton pledget.
- 3/ Then dust crystalline sulfanilamide over the surface. No patient is to receive more than 15 grams per 24-hour period.
- 4/ Dressing:
 - a/ Warm saline packs, moistened with warm saline every 3 or 4 hours.

b/ Frost lightly with sulfanilamide at each redressing.

(e) Comments:

- 1/ Once the tan has been accomplished, it should not be removed, other than stated in II-B (5) (d), 1/.
- 2/ Skin will regenerate beneath tan if burn is second degree and the tan will spontaneously separate.
- 3/ In third degree burn, if the tan remains intact, do not remove until six weeks have elapsed; then prepare for skin graft.

(6) Alternate Treatment:

- (a) Solution of physiologic saline containing 0.2% sulfanilamide using a waterproof irrigation bag, similar to the Bunyan-Stannard oiled silk envelope.

III. GENERAL COMMENTS ON TREATMENT:

1. Chemotherapy:

- A. Sulfadiazine - one gram every 6 hours (day and night) for 10 days.
- B. If output of urine is below 1,000 cc per day (24 hours), adjust sulfadiazine dose so as to maintain its concentration in the blood of 10 mgms. percent.
- C. In complete suppression, stop drug and force fluids both orally and intravenously.

2. Intravenous Therapy:

- A. Blood plasma: Object is to replace the volume of serum lost. May be administered before any laboratory work is done.
 - (1) Always give in divided doses.
 - (2) Amount required during first 24 hours (Enclosure A):

- (a) 10% of surface burned, use 1,000 cc.
- (b) 20% of surface burned, use 2,000 cc.
- (c) If possible, do hematocrit determinations. For each point above 50% cells, 100 cc of plasma should be given.

(3) Always give intravenously.

(4) Repeat as indicated.

B. Human serum albumin (concentrated):

- (1) One gram will extract at least 15 cc of fluid from the tissues provided tissues are normal body hydration.
- (2) One unit (100 cc) is equivalent, therapeutically, to approximately 500 cc of plasma.
- (3) Amount required during first 24 hours (Enclosure A):

- (a) 10% of surface burned, use 2 units.
- (b) 20% of surface burned, use 4 units.

(4) Always give intravenously.

(5) Repeat as indicated.

C. Physiologic saline and glucose:

- (1) Should not exceed the volume of plasma injected in any one 24 hours, except in those instances where there is severe hemoconcentration, e. g., hematocrit about 70% cells.

D. Whole Blood:

- (1) To be given early only in case of actual hemorrhage or some other injury.
- (2) In case secondary anemia should develop, give 500 cc of whole blood daily until anemia is overcome.

E. The femoral vein is satisfactory for venipuncture as a substitute for the vein in the arm. It can easily be reached by introducing the needle at right angles to the skin $1\frac{1}{2}$ inches below the mid-point of Poupert's ligament just medial to the palpable pulsating femoral artery.

F. Detergents: Below are listed the recommended detergents in relative order of desirability. All are used in a 5% solution.

- (1) Dreft, a dry powder, is a fatty alcohol sulphate.
- (2) Drene is identical with Dreft except that it is a concentrated solution.
- (3) Orvus is identical with Dreft except that it is a paste.
- (4) Arctic-Snytex-M is a sulphate of a monoglyceride.

3. Prevention of Infection:

A. General principles.

- (1) Surgical asepsis should be maintained by those doing dressings.
- (2) Dressings should be done at least one hour after sweeping down and changing linens. Avoid drafts and unnecessary traffic.
- (3) The dressing party and patients should be masked during dressing period.
- (4) Those with upper respiratory infections should not engage in care of burned patients.
- (5) All soiled linen and dressing should immediately be placed in a closed container after removal from bed or patient.

RELATIVE SKIN AREAS ACCORDING TO BERKOW

ADULTS

TRUNK	38 %
LOWER EXTREMITIES	38
UPPER EXTREMITIES	18
HEAD	6

CHILDREN

TRUNK	40 %
LOWER EXTREMITIES 12-AGE IN YEARS	38
UPPER EXTREMITIES	16
HEAD 12-AGE IN YEARS	6

BERKOW'S METHOD OF ESTIMATING EXTENSIVENESS OF SKIN LESIONS



